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Arduino-based Automatic Fish Feeding Device Prototype

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ABSTRACT

Consuming fish food is an important part of the process of growing and maintaining fish. In general, fish food is given by conventionally throwing it by hand. However, this is not done at the same time every day. Based on the problems above, the researchers made a prototype of an Arduino-based automatic fish feeding device. The aim of this research is to determine the effectiveness of the automatic fish feeder prototype. In the prototype that the researchers made using several main components such as Arduino Uno as the system or brain of this prototype, servo motor, 20 x 4 LCD, buttons, Real Time Clock (RTC), and several jumper cables. The effectiveness of this tool can be seen from the test results, where the automatic fish feeder prototype succeeded in providing fish food according to a predetermined schedule.

Keywords: *Arduino, Automatic, Fish Feeder Prototype*

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INTRODUCTION

Meeting the nutritional needs of fish is critical in aquaculture, and according to reference (Manganang & Mose, 2019), it is a crucial factor in intensive fish farming. Particularly with the increasing demand for fish, the quality and weight of fish are usually dependent on the nutritional value of the feed provided by fish farmers. Feeding fish using conventional methods such as direct hand-feeding is considered inaccurate due to the inconsistency in feeding times. As a result, conventional hand-feeding is considered ineffective, and fish do not grow with optimal quality. Prototype automatic fish feeder based on Arduino is a device that feeds fish automatically without the need for fish farmers to come to the pond every day. Additionally, it reduces the workload for fish farmers and allows them to focus on other processes such as hatchery and nursery, optimizing the fish farming process and saving time. The prototype device utilizes an

Arduino component to process data, a Real Time Clock (RTC) as a comparator for inputted schedules, and a servo motor to dispense fish feed.

The research problem focuses on creating an automatic feeding schedule for fish. The objective of this report is to devise a prototype device that dispenses fish feed by using a servo motor and automatically delivers the fish feed according to the scheduled time entered using the Real Time Clock (RTC).

Theoretical Foundation

1) Arduino Uno R3

Arduino Uno R3 is a minimum system board based on the AVR type ATmega328P microcontroller. Arduino Uno R3 has 14 digital inputs/outputs (6 of which can be used for PWM output), 6 analog inputs, 16 MHz crystal oscillator, USB connection, power jack, ICSP header and reset button (Faizin dkk., 2023). Programming in Arduino is usually called a sketch, as for the software used, namely the Arduino IDE. Arduino itself is an open-source platform which is used to create electronic projects (Tullah dkk., 2019). Arduino IDE can also be interpreted as an application used to create programs in Arduino, in other words as a medium for programming the Arduino board (Nugroho, 2022). Arduino Uno itself has 14 digital input and output pins of which 6 are used as PWM outputs. Then 6 analog input pins, a connection using USB and a reset button (Bintang dkk., 2023)

Figure 1. Arduino Uno R3

2) 20 x 4 LCD and I2C Module

Liquid Crystal Display (LCD) is a device that is often used to display data other than using a seven segment. LCD functions as a means of communicating with humans in the form of text or image characters (Suyatmo dkk., 2020). According to reference (Sarmidi, 2019), LCD (Liquid Crystal Display) is a type of electronic display made using CMOS technology, which is logic that works by not producing light but reflecting the light around or transmitting backlight. The following is the physical form of the LCD used in the design of the tool as follows:

Figure 2. 20 x 4 Liquid Crystal Display (LCD) and I2C

Inter Integrated Circuit or better known as I2C is a two-way serial communication standard using two channels specifically designed to send and receive data. The I2C system consists of SCL (Serial Clock) pins and SDA (Serial Data) pins that carry data information between I2C and its controller (Nulhakim, 2019). I2C/TWI LCD, is a module used to reduce the use of feet in the LCD. This module has 4 pins that will be connected to the Arduino. Arduino uno already supports I2C communication with the I2C lcd module, so it can control 16x2 and 20x4 Character LCDs using only 2 Pins, namely Analog Input Pin 4 (SDA) and Analog Input Pin 5 (SCL) (Natsir dkk., 2019).

3) Push Button

Push button is an electronic component that can break and flow electric current in an Arduino project circuit. Where this disconnection and flowing occurs due to the principle of transferring from one conductor to another. The method is by direct manual operation by the user (Situmorang, 2021). Basically, the working principle of a push button is to break and connect the flow of electricity (Pradana Rachman, 2022). On a push button, it is not locking. So, it will return to the all position when it is finished being pressed. When the push button is pressed, it becomes HIGH and will conduct electricity. Meanwhile, when released, it is LOW and cuts off the electric current. However, the way a push button switch works is sometimes different depending on its type. Whether it includes NO or NC (A dkk., 2022).

Figure 3. Button

4) RTC DS3231

Real Time Clock (RTC) is an electronic clock in the form of a chip that can calculate time (from seconds to years) accurately and maintain / store the time data in real time. RTC chips are often found on PC motherboards (usually located near the BIOS chip). All computers use RTC because it functions to store the current clock information of the computer in question. RTC is equipped with a battery to supply power to the chip so that the clock will remain up-to date even if the computer is

turned off. RTC is considered quite accurate as a timer because it uses a crystal oscillator (Maharmi dkk., 2019).

Figure 4. RTC DS3231

Real Time Clock (RTC) is an IC that has a function to calculate time, starting from seconds, minutes, hours, dates, months, and years. The DS3231 RTC IC has an internal crystal and tuning capacitor circuit where the temperature and crystal are monitored continuously, and the capacitor is automatically adjusted to maintain the stability of the frequency beat (Qomaruddin dkk., 2019).

5) Servo Motor

Servo motors are rotary actuators (motors) capable of working in two directions (Clockwise and Counterclockwise). Servo motors can move from 0 degrees to 360 degrees (Fakhri dkk., 2020). Servo motor is also a motor with a closed feedback system where the position of the motor will be informed back to the control circuit in the servo motor is also one type of DC motor (Pal & Malarvizhi, 2021).

Figure 5. Micro Servo SG90

6) Jumper Cable

Figure 6. Jumper Cable

According to reference (Rahimoon dkk., 2020), jumper cables are electrical cables that function to connect between components in the breadboar without the need to solder first. The connector at the end of the cable consists of two types, namely male connectors (male connectors) and female connectors (female connectors). The male connector functions to pierce and the female connector

functions to be pierced (Hari dkk., 2022). Jumper cables are used to distribute electrical energy. An electrical cable consists of insulators and conductors insulators are cable wrapping materials usually made of plastic or rubber, while conductors are made of copper (Siregar dkk., 2022).

RESEARCH METHODOLOGY

The research method used in this research is the literature study method and the design method. The literature study method where all the necessary data comes from articles, books or other sources that are still sustainable (Rahmadian dkk., 2022). Then, for the design method used in determining the design before making the tool, data observation by looking for sources that are connected to the tool to be used.

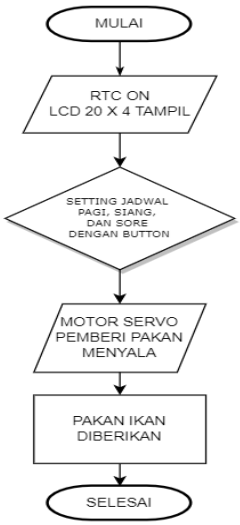
The components of the automatic fish feeder prototype can be seen in Table I below.

Table 1. Components Of The Arduino-Based Automatic Fish Feeding Device Prototype

No.	Component Name	Total
1.	Arduino Uno R3	1 Pcs
2.	20 x 4 LCD	1 Pcs
3.	I2C LCD Module	1 Pcs
4.	Push Button	1 Set
5.	Servo Motor	1 Pcs
6.	RTC DS3231	1Pcs
7.	Jumper Cable	To taste

The performance of this arduino-based automatic fish feeder prototype can be seen as in Figure 7. The flowchart describes the working mechanism of the tool made as follows.

Figure 7. Flowchart of Automatic Fish Feeding Device Prototype



A. Data Collection Procedure

The data collected in this study are:

1. Real Time Data: Data in the form of adjusted time based on RTC time.
2. Fish Feeding Data: This data was obtained after a trial by feeding with the device.
3. Time Storage Data: This data is obtained by testing the amount of input data with the function of the device.

B. Drafting Design

This tool uses a 12V adapter and battery to be used as a power supply, Arduino Uno as a tool system, a 20 x 4 LCD is used to display the time, date, and notification message while feeding the fish, and a servo motor to feed the fish. The overall design of this prototype can be seen in Figure 7. Then, for the Arduino-based automatic fish feeder prototype circuit can be seen in Figures 8 and 9 and the design results in Figure 10 as follows:

Figure 8. Tool Prototype Design

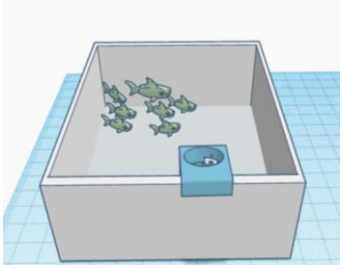


Figure 9. Circuit Design 1

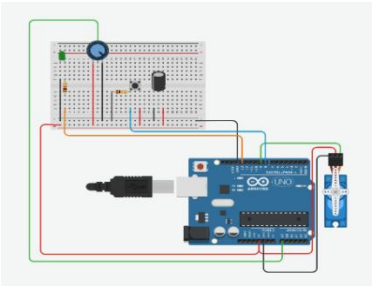


Figure 10. Circuit Design 2

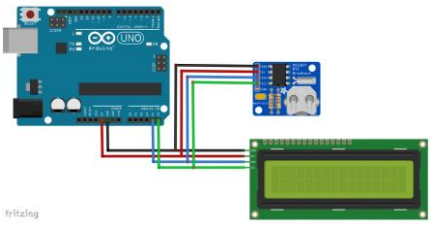


Figure 11. Design Results

RESULT AND DISCUSSION

The results and discussion are carried out for the purpose of knowing the performance of the tools that have been made whether they function properly, and the level of feasibility seen from the ease of use and the benefits obtained from the tools that have been made.

A. 20 x 4 LCD and RTC Testing

This test is carried out to ascertain whether the 20 x 4 LCD is active, and the *Real Time Clock* (RTC) used is appropriate to display the time on the 20 x 4 LCD. This is done by trying to deactivate and reactivate the device to ensure the condition of the LCD and RTC is in accordance with the time.

Table 2. 20 X 4 LCD AND RTC TRIAL DATA

Experiment	LCD and RTC conditions	Status
Trial 1	Light up	As per
Trial 2	Light up	As per
Trial 3	Light up	As per
Trial 4	Light up	As per

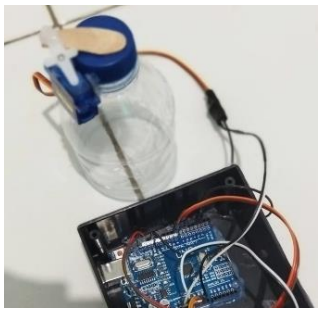
Figure 12. RTC and LCD 20 x 4 Trial

B. Servo Motor and RTC Testing

Testing is done by adjusting the existing input to the RTC time displayed on the 20 x 4 LCD. The first experiment was at 14:24 WIB. If the RTC input matches what the user enters, the servo motor will run to open or close the fish feed. The first test can be seen as follows.

Figure 13. Servo Motor and RTC Testing

Figure 14. Servo Motor Testing



Furthermore, the second test at 14.26 WIB and the last experiment to ensure whether the servo motor runs according to the time input from the RTC. The result is that the servo motor runs to open and close based on the time entered.

C. Fish Feeding Device Testing

The next test is to test whether the tool can feed the fish according to the entered time schedule both in the morning, afternoon, and evening. The first test entered the feed schedule on the tool for the afternoon schedule at 14.22 WIB, can be seen as follows.

Figure 15. Testing the Tool on the Afternoon Schedule

The next test entered the feed schedule for the afternoon schedule at 14.23 WIB, can be seen as follows.

Figure 16. Testing the Tool on the Afternoon Schedule

Figure 17. Tool to Dispense Fish Feed on Schedule

The result of the test is that the automatic fish feeder prototype tool is successful in providing fish feed according to the entered schedule for both morning, afternoon, and evening schedules.

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded as follows.

1. This tool works well with feeding based on the specified time according to the time settings that you want to feed both morning, afternoon, and evening schedules.
2. This tool is able to provide fish feed with a distance of 1 meter from where this tool is located, allowing fish not to fight for feed.
3. The use of electrical power with the adapter is more stable because it is with the help of 12VDC power.

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